EPA/ROD/R04-93/152
1993

EPA Superfund
Record of Decision:

STAUFFER CHEMICAL CO. (LEMOYNE PLANT)
EPA ID: ALD008161176
OU 03
AXIS, AL
09/17/1993

RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

STAUFFER CHEMICAL (LEMOYNE PLANT) SUPERFUND SITE
STAUFFER CHEMICAL (COLD CREEK) SUPERFUND SITE

OPERABLE UNIT #3-COLD CREEK SWAMP

MOBILE COUNTY, ALABAMA

PREPARED BY

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ATLANTA, GEORGIA

DECLARATION
of the
RECORD OF DECISION

OPERABLE UNIT NO. 3-COLD CREEK SWAMP

SITE NAME AND LOCATION

Stauffer Chemical (LeMoyne Plant) Superfund Site
Stauffer Chemical (Cold Creek Plant) Superfund Site
Mobile County, Alabama

STATEMENT OF BASIS AND PURPOSE

This decision document (Record of Decision), presents the selected remedial action for Cold Creek Swamp (OU3) for the Stauffer Chemical (LeMoyne Plant) Superfund Site and the Stauffer Chemical (Cold Creek Plant) Superfund Site, Mobile County, Alabama, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) 42 U.S.C. Section 9601 et seq., and to the extent practicable, the National Contingency Plan (NCP) 40 CFR Part 300.

This decision is based on the administrative record for the Stauffer Chemical (LeMoyne Plant) Superfund Site and the Stauffer Chemical (Cold Creek Plant) Superfund Site ("the Site" or "the Sites").

The State of Alabama, as represented by the Alabama Department of Environmental Management (ADEM), has been the support agency during the Remedial Investigation and Feasibility Study process for the Stauffer Chemical Superfund Site. In accordance with 40 Part CFR 300.430, as the support agency, ADEM has provided input during this process. The State of Alabama has concurred with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances (pollutants or contaminants) from the Stauffer Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare and/or the environment.

DESCRIPTION OF SELECTED REMEDY

This operable unit is the third of four at the Stauffer Sites. Operable unit one was enumerated by a Record of Decision that was signed by EPA on September 27, 1989. Operable unit two addressed the migration of contaminants present in the surficial aquifer at the Site. Operable unit three, which is enumerated by this Record of Decision, addresses contamination at the Site in Cold Creek Swamp. The major components of the selected remedy for Cold Creek Swamp, operable unit three, include:

- Implementation of multimedia capping on the Upper Arm Swamp Zone with surface water diversion. The cap will consist of clean soil, a compacted clay layer, a high density polyethylene gasventing layer, a drainage layer, and a soil revegetation layer.

- Sheet piling constructed in two cross-sectional cells as an in-stream barrier to isolate the Upper and Middle Swamp Zones.

- Creation of wetlands using native species in the new surface water diversion channel as mitigation of the wetland area destroyed by the capping of the Upper Arm Swamp Zone.

- Excavation of contaminated soil from the Transition Zone and disposing of it in the Upper Arm Swamp Zone before capping. The actual extent of excavation will be determined during the Remedial Design phase.

- Revegetation of the Transition Zone and restoration to a wetland status.

- Annual monitoring of the entirety of Cold Creek Swamp for 10 years after remedial action is completed.

- Long-term monitoring to assess the long term effectiveness of capping as a containment action.

- Institutional controls including building up of the levees between Cold Creek Swamp and the Mobile River to limit the exchange of contaminants to the river. Posting of "No Fishing" and "No Hunting" signs are also required.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. Finally, it is determined that this remedy maximizes long-term effectiveness.

However, because treatment of the principle threats of the Sites was not found to be practicable, this remedy does not satisfy the statutory preference for treatment as a principle element.

Because this remedy will result in hazardous substances remaining onsite, a review will be conducted within five years after commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

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1.0 SITE LOCATION AND DESCRIPTION

The Stauffer Chemical (LeMoyne Plant) and Stauffer Chemical (Cold Creek Plant) Superfund Sites are located in Mobile County, on Highway 43, in Axis and Bucks, Alabama, approximately 25 miles north of the city of Mobile. Since the LeMoyne and Cold Creek Sites are adjacent to one another, their remedial activities are being completed together; therefore, the LeMoyne and Cold Creek Sites are often referred to as the Stauffer Superfund Sites.

Cold Creek Swamp is located in the northeast section of the Stauffer Superfund Sites. Cold Creek Swamp encompasses approximately 650 acres situated between U.S. Highway 43 to the west and the Mobile River to the east. The wetland is bounded by the Alabama Power Company Barry Steam Generating Plant discharge canal to the northeast, the Mobile River to the east, and the manufacturing facilities to the south and west. While this area is an industrial corridor, a large portion of the land is undeveloped, particularly in the bottomland areas. The surrounding area is sparsely populated and consists primarily of bottomland hardwoods and other wetlands. It is situated along the Mobile River, approximately 10 miles south of the confluence of the Tombigbee and Alabama rivers and 20 miles north of Mobile Bay. The Mobile River in Mobile County is an important water source for river barge transportation, as well as other industrial, agricultural, and recreational uses. Other water supply sources in the Site vicinity include wells, springs, and ponds. Surrounding land use in the immediate vicinity of Cold Creek Swamp is predominately industrial, related to chemical processing and electrical power generation. However, some small, residential communities are located within a three mile radius.

Cold Creek drains the wetland, flowing generally east through the wetland and ultimately discharging to the Mobile River. The uppermost portion of the wetland is located on the LeMoyne and Cold Creek plant property and is drained by an unnamed tributary to Cold Creek. See Figure 2-1 for a map of the study area addressed in this ROD.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Stauffer Chemical Company previously owned and operated a multiproduct chemical manufacturing plant at LeMoyne, Alabama, and an agricultural chemical facility at the adjacent Cold Creek Site. The LeMoyne Site was acquired by Akzo Chemie America (now Akzo Chemicals, Inc.) in 1987. The Stauffer (LeMoyne Plant) began operating in 1953 with a retort carbon disulfide plant followed by a reactor carbon disulfide plant in 1956. Several other facilities were subsequently added and include a sulfuric acid plant (on line in 1957), a carbon tetrachloride plant (1963), a caustic/chlorine plant (1964), and a Crystex (a proprietary sulfur compound) plant (1974). The caustic/chlorine process has since been discontinued and dismantled. Akzo continues to operate all other processes mentioned above.

The Cold Creek Plant has been in operation since 1966 at which time it was purchased by ICI Americas, Inc., from Stauffer. ICI Americas Inc., has since been renamed Zeneca, Inc. This facility has also expanded its operations over the past 20 years and has manufactured, and continues to manufacture, a variety of agricultural chemicals, including thiocarbamates. Halby Chemical Company (later part of Witco, Inc.) also operated a facility from approximately 1965 to 1979 on a leased section of the LeMoyne property. Witco, Inc., purchased the Halby Chemical Company facility in 1974 and continued to manufacture dye chemicals, including sodium hydrosulfide, until 1979.

The major contaminant believed to have come from these operations is thiocyanate.

Stauffer and ADEM discovered groundwater contamination in both onsite and offsite wells in the early 1970's. To monitor contamination in groundwater, Stauffer installed twenty-one monitoring wells in 1973. By 1977, water quality had deteriorated substantially and seven observation

wells were placed at the southern property line of the LeMoyne plant. The Alabama Water Improvement Commission (AWIC), predecessor to today's Alabama Department of Environmental Management (ADEM), approved the installation of three interceptor wells accompanied by an air stripper on the LeMoyne property in late 1980.

Over the years, several improvements and waste-handling modifications were made including the construction of lined wastewater ponds and the closure of some old unlined ponds. In 1975, the unlined landfill located one mile east of the LeMoyne plant containing 11,000 to 12,000 tons of brine muds, plant refuse, used samples, and absorption oil was closed using an impermeable membrane cap and side-wall liner under the direction of AWIC. Improvements made at the Cold Creek plant in 1974 included closure of the Cold Creek North and South Landfills with geomembrane caps and side-wall liners. These landfills contained a variety of herbicides and pesticides.

Several wastewater ponds were closed under the direction of AWIC, and the use of clay-lined ponds has ceased. Several membrane-lined ponds which are currently active were installed during the 1970's to replace the clay-lined ponds.

At present, the Sites contain ten (10) closed or inactive wastewater ponds and four active ponds near the wetland. The four (4) active ponds are membrane-lined and monitored regularly. Of the ten (10) inactive ponds, six (6) are closed and covered. A wastewater treatment pond associated with the old carbon tetrachloride plant is lined and contains approximately 1900 yd[3] of sulfur sludge. A brine mud pond associated with the chlorine plant was originally a RCRA facility, but the contents have since been delisted from status as a hazardous waste and the pond has been closed. A newer brine mud pond which was permitted in conformance with RCRA standards was recently closed and closure documentation has been submitted to ADEM for approval.

The Alabama Department of Public Health conducted an assessment of the Site in 1982 in response to submissions made by Stauffer to the House Committee on Interstate Commerce (the Eckhardt Study). Additional monitoring wells were installed around the LeMoyne Landfill based on the advice of ADPH. Data obtained from these wells formed the basis for the NPL listing of both Sites in September of 1983. The Hazard Ranking Score (HRS) for the Stauffer Chemical Cold Creek Site was 46.77. Application of EPA's HRS to the Stauffer Chemical LeMoyne Site yielded a score of 32.34.

On November 21, 1984, EPA issued a Notice Letter and Information Request to Stauffer for the execution of a Remedial Investigation/Feasibility Study (RI/FS) at the Stauffer Chemical Cold Creek Site. On November 23, 1984, EPA issued to Stauffer a Notice Letter and Information Request for the preparation of a RI/FS at the Stauffer Chemical LeMoyne Site. Stauffer expressed its interest in conducting the RI/FS in a letter dated December 21, 1984. Under a contract with EPA, Camp, Dresser, and McKee, Inc., performed preliminary sampling in May 1985 to assist in preparing a work plan for the RI/FS. Stauffer and EPA entered into an Administrative Order on Consent (AOC), Docket No. 86-04-C, on January 21, 1986. Pursuant to the AOC, Stauffer agreed to conduct the RI/FS at both Sites and to reimburse EPA for all costs of response and oversight incurred by the United States. Subsequent to the effective date of the AOC, ICI Americas, Inc. (presently, Zeneca), purchased the LeMoyne and Cold Creek plants. Shortly thereafter, Akzo purchased the LeMoyne plant from ICI Americas, Inc. Akzo and ICI Americas, Inc., continued the RI/FS to completion. These potentially responsible parties (PRPs) completed the RI in July 1988 and the FS in January 1989.

On July 11, 1989, EPA issued a Proposed Plan for remedial activities which addresses groundwater contamination at the Sites. EPA then issued Special Notice Letters to Akzo and ICI Americas, Inc., on July 20, 1989, relating to the Remedial Design/Remedial Action (RD/RA) for groundwater remediation. EPA executed a Record of Decision (ROD)on September 27, 1989. Under the provisions

of the ROD, EPA established three Operable Units. Operable Unit 1 (OU1) addresses groundwater and contaminant sources, Operable Unit 2 (OU2) addresses source units, and Operable Unit 3 (OU3) refers to the Cold Creek Swamp. The Consent Decree (CD) for the conduct of the RD/RA for OU1 was lodged on April 25, 1990. At present, the PRPs are operating a groundwater recovery and treatment system which includes interceptor wells with flow rates from 325 to 420 gallons per minute (gpm).

The on-site sources of contamination at both Sites are designated as OU2. The September 27, 1989, ROD for OU1 identified nine (9) Solid Waste Management Unit (SWMU) Areas. These SWMU Areas include twelve (12) separate SWMUs. Subsequently, in March 1991, Region IV's RCRA Branch conducted a RCRA Facility Assessment at the Akzo facility (the LeMoyne plant) and identified a total of 139 SWMUs and fourteen (14) Areas of Concern (AOCs). Of the 139 SWMUs, EPA only identified eight (8) as requiring a full investigation. During a meeting on March 13, 1992, and in a letter dated May 1, 1992, EPA informed the PRPs that a RI/FS must be conducted for OU2 (on-site sources). EPA's authority to require this RI/FS was based on Section VI, Paragraph 1 of the AOC. Akzo and ICI Americas, Inc. (Zeneca), requested that EPA include less than the entire 139 SWMUs in OU2 and that EPA handle the remaining SWMUs under the Corrective Action portion of Akzo's RCRA permit. Based on an agreement between the CERCLA and RCRA branches, Region IV included six (6) additional SWMUs in OU2. The addition of these six (6) SWMUs to the twelve (12) SWMUs identified in the ROD for OU1 brings the total number of SWMUs in OU2 to be handled under CERCLA to eighteen (18).

An August 6, 1992, EPA letter documents a consensus reached between EPA and the PRPs for a three-phased approach which has been implemented for the RI/FS Work Plan for OU2. On December 29, 1992, EPA approved a Decision Document which was prepared to assess available information on eighteen (18) SWMUs in OU2, to determine the appropriate course of action at these SWMUs, and to make recommendations for addressing source contamination.

In a letter dated May 4, 1990, EPA notified the PRPs that a determination had been made that pursuant to Section VI, Paragraph I of the AOC, supplemental investigatory work and/or engineering evaluation was necessary for OU3. Akzo and Zeneca responded in a May 22, 1990, letter stating that the PRPs were willing to conduct the supplementary work. The additional study (RI/FS) was conducted to better define the nature and extent of contamination and potential human health and ecological risk existing in the wetland. In addition to identification of the hazardous substances present in sediments and surface water and the characterization of risk posed by the presence of these contaminants, the additional study also included extensive biological sampling, including finfish, herptiles, and invertebrates from the wetland and other locations determined to represent background, and an analysis of these organisms for whole-body mercury tissue concentration.

On May 25, 1993, EPA issued a "Notice of Decision Not To Use Special Notice Procedures" to the potentially responsible parties (PRPs) for the Stauffer Sites, Akzo and Zeneca, to the PRP for the Ciba-Geigy Site, CibaGeigy Corporation, and to the PRP for the Olin Corporation Site, Olin Corporation. The notice letter informed the PRPs, including those for the Stauffer Sites, of the designation of a length of the Mobile/Tombigbee river system from just north of the Ciba-Geigy Site to just south of the Stauffer Chemical LeMoyne Site as Operable Unit 4 for the Stauffer Sites, Operable Unit 5 for the Ciba-Geigy Site, and Operable Unit 3 for the Olin Corporation Site. EPA intends to conduct an initial, yet comprehensive, RI to determine the areal extent of contamination in the river system due to the release of hazardous substances and pollutants or contaminants from the four NPL Sites. EPA Region IV's Environmental Services Division has prepared a draft Work Plan.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION FOR COLD CREEK SWAMP (OU3)

An availability session was held on February 6, 1991, in the Toulminville Public Library at the start of field work for the RI for Cold Creek Swamp. Two subsequent availability sessions were held on April 21 and 22, 1992, at the Dead Lake Marina and Little Rock Baptist Church, respectively. Both are located in Axis, Alabama. These subsequent availability sessions were to update the community on activities through the RI/FS.

The main branch of the Saraland Public Library at 111 Saraland Loop, Saraland, Alabama, was chosen as the local information repository for the Site. Saraland Public Library will be the information repository for six months at which time it will be moved to the new Satsuma Library. The public comment period on the proposed plan preceding this ROD (OU3) was held June 15, 1993, through July 14, 1993. A public meeting was held on June 29, 1993, where representatives from EPA answered questions from approximately 50 people regarding the Site and the proposed plan under consideration.

The administrative record, including the RI/FS Report and the Proposed Plan, was available to the public at both the information repository and at the EPA Region IV Library at 345 Courtland Street in Atlanta, Georgia. The notice of availability of these documents was published in the Mobile Register Press on June 15, 1993, and June 24, 1993. EPA received numerous oral and written comments during the comment period. Responses to the significant comments received are included in the Responsiveness Summary, which is part of this ROD, and is designated Appendix A.

This decision document presents the selected remedial action for operable unit three of the Stauffer Sites, chosen in accordance with CERCLA, as amended by SARA and to the extent practicable, the NCP.

The decision for this Site is based on the administrative record. The requirements under Section 117 of CERCLA/SARA for public and state participation have been met for this operable unit.

4.0 SCOPE AND ROLE OF OPERABLE UNITS

EPA has organized the work at this Superfund Site into four operable units (OUs). These units are as follows:

OU1 Contamination of the aquifer emanating from the Site. A Record of Decision was issued on OU1 in September, 1989. A groundwater pump and treat system is currently in place. Three groundwater extraction wells are in operation and three more will be on line in 1993.

OU2 Contamination of the source areas at the Site. This addresses 18 waste disposal areas including the landfills, the active ponds, and the Old Carbon Disulfide Wastewater Treatment Pond. An RI/FS is currently underway to determine the extent of contamination and evaluate possible cleanup alternatives.

OU3 Contamination of Cold Creek Swamp. Addressed by this Record of Decision.

OU4 Contamination of the Mobile River. An EPA lead investigation is underway to determine the extent of contamination in the Mobile River from releases from the Stauffer Superfund Sites.

This Record of Decision addresses Cold Creek Swamp (OU3). The wetland received contaminated wastewaters from the former operations at the manufacturing facilities. A June 1992 Supplemental Remedial Investigation Report documents the details of the study of contamination in the wetland. A November 1992 Supplemental Feasibility Study Report and the March 1993 Supplemental Feasibility Study Report Addendum submitted by Akzo Chemicals Inc./Zeneca Inc.,

documents the development, screening, and detailed evaluation of potential alternatives and risk posed by the contaminants as they relate to the Site. Furthermore, EPA has issued a December 10, 1992, caveat to the RI Report and a June 3, 1993, caveat to the FS Report. Based upon this evaluation, EPA will determine which alternative or combination of alternatives which will achieve the CERCLA remediation objectives.

5.0 SUMMARY OF SITE CHARACTERISTICS

This is a summary of the major Site characteristics presented in the RI/FS Study, the BCM Biota Study, and the Supplementary RI/FS Study. In 1990, EPA, based upon comments from the U.S. Fish and Wildlife Service and the National Oceanic and Atmospheric Administration on the original 1988 RI Report, EPA required that additional studies be conducted within Cold Creek Swamp to better define the nature and extent of contamination and potential human health and ecological risk. In response to EPA, Akzo Chemicals Inc./Zeneca Inc. initiated a Supplementary RI/FS. It included: the sampling of surface water within the wetland; collection of sediment samples at various depths at over one hundred locations within the wetland; and extensive biological sampling. Results of receptors of concern screening and the preliminary ecological exposure model were used to scope field activities focusing on biota collection/analysis. Biota samples included finfish, herptiles, and invertebrates from the wetland and reference locations which were analyzed for whole-body mercury tissue concentration. The final step in the RI process was development of baseline human health and environmental risk assessments and examination of migration of contaminants.

5.1 GEOLOGY/PHYSIOGRAPHY/SOILS/SEDIMENTS

The results of the RI led to the following findings and conclusions:

- The Site lies in the Southern Pine Hills Section (Piney Meadows Subsection) of the East Gulf Coastal Plain Physiographic Province. Within the Southern Pine Hills Section of the Coastal Plain, the underlying sedimentary units are overlain by Miocene estuarine deposits consisting of interbedded sands and clays, and in some areas the younger Pliocene Citronelle Formation which generally consists of sand and gravel. These deposits are in many areas overlain and incised by younger Pleistocene- and Holocene-age alluvial deposits, with deposition occurring from long-term sedimentation from several north/south-tending streams and rivers.

- The Site is underlain by low river terrace and alluvial deposits that are approximately 110 to 130 feet thick. The deposits consist of generally clean, unconsolidated, fine to very coarse grained sands that contain some interbedded, discontinuous clayey seams and some gravelly zones. The upper sands have moderate to low permeability.

- Cold Creek Swamp is a flat, low lying area on the west bank of the Mobile River. The Cold Creek drains the wetland, flowing generally west to east through the wetland and ultimately discharging to the Mobile River. The uppermost portion of the wetland (Upper Swamp, Zone I) is located on the LeMoyne and Cold Creek Plant property and is drained by an unnamed tributary to Cold Creek. It is characterized by level to undulating topography with several pools and minimal stream flow through most of the year. The wetland is relatively narrow and heavily wooded in the Middle Swamp (Zone II) until it reaches two power line cuts. At the power line cuts, the wetland broadens and supports dense woody vegetation (Lower Swamp, Zone III). Cold Creek flows along the south and southeastern edge of the wetland and discharges into the Mobile River approximately 1/2 mile downstream of the Alabama Power Company Barry Steam Generating Plant cooling water discharge canal. An unnamed tributary to Cold Creek discharges to the wetland in the vicinity of the power line cuts. (Figure 2-1)

- Surface elevations in the wetland range from highs of about 30 feet above mean sea level (MSL) in the Upper Swamp (Zone I) at the two plant Sites, to lows of approximately 6 feet MSL in theLower Swamp (Zone III) along the Mobile River. Much of the Middle and Lower Swamp, with elevations of less than 10 feet MSL, become flooded by overflow from the Mobile River during Spring storm events.

- The two main soil associations within Cold Creek Swamp are the Izagora-Bethera and the Dorovan-Levy. The Izagora Bethera Association is most prominent in the narrow western portion of the Site (Zones I & II) and characterized by loamy marine sediments and poorly drained clayey soils. The Dorovan-Levy Association is the dominant soil association found in the broad eastern portion (Zone III) of Cold Creek Swamp. This association consists of very poorly drained soils located in depressional wetlands and bottoms along the Mobile River, and is dissected by meandering streams.

- Examination of the Supplementary RI soil/sediment sampling data indicates mercury is the Chemical of Concern. Other potential Chemicals of Concern that were identified include thiocarbamates, aluminum, cadmium, copper, and zinc. The extent of contamination is restricted primarily to the upper 1-3 ft of the soil/sediment. Examination of the sample analyses indicated that the mercury seems to be bound to the soil/sediment particles in the upper 3 feet. Methyl mercury is extremely bioaccumulative resulting in uptake in biota and effects in the upper trophic levels through biomagnification.

- The two locations of major mercury concentrations are in the Upper Arm Swamp Zone located near Zeneca, Inc., and at the transition from the Middle to Lower Swamp (Transition Zone) where Cold Creek bends and intersects the power lines. (Figure 3-1)

- Surficial soil/sediment samples collected in the Supplementary RI reinforce previous data collected for soil/sediment and soil boring samples with regard to mercury location. The highest mercury concentrations ranged from 7560 mg/kg in the Upper Arm Swamp Zone to 632 mg/kg in the Transition Zone at the power lines.

5.2 SITE HYDROLOGY

- Surface water runoff from approximately 1,100 acres, including the western part of the LeMoyne Plant property, a portion of the north-central part of the adjacent Courtaulds Fibers property, and a part of the adjacent Route 43 right-of-way, flows through the drainage channels within the LeMoyne Plant, ultimately discharging to an unnamed tributary to Cold Creek at the head of the Upper Arm Swamp Zone. This stream flows generally north-northwest through a series of ponds and pools within the Upper Arm Swamp Zone. Flow from another unnamed tributary joins Cold Creek from the east in the Middle Swamp west of the western power line right-of-way. At this point, Cold Creek then flows southeasterly to a series of ponds in the Lower Swamp. Discharge channels emanating from the lowest pond in the Lower Swamp cut through the shoreline levee at no less than two points where the wetland meets the Mobile River. Water flow through the wetland is a function of the stormwater runoff and the fluctuating Mobile River stages. Under static conditions there is generally no flow and the wetland is a series of ponds and pools. Much of the Lower and Middle Swamp become flooded by overflow from the Mobile River during spring storm events.

- Surface water samples were collected from two locations in the unnamed tributaries to Cold Creek. The locations were not within the limits of the wetland and were intended as reference conditions. The only compounds detected in these samples were mercury at 0.0002 mg/L and zinc at 0.31 mg/L. No priority pollutants, organics, or polychlorinated biphenyls (PCBs) were detected in these samples. Methyl mercury was detected in the

wetland sediments. While part of the mercury is in the form of the relatively insoluble sulfide, a portion is in a bioavailable form.

- Surface water samples collected during the supplemental RI did not contain any volatile or semi-volatile organic compounds, pesticides, PCBs, thiocarbamates, or thiocyanate above detection levels. The observed compounds found to exceed water quality criteria for toxicity to aquatic organisms in the surface water samples were metal concentrations of mercury, silver, and zinc. Of these only mercury was considered to represent a potential risk to ecological receptors but not to human health based on the established exposure scenarios.

- The Site is located on the Mobile River Valley watertable aquifer which is recharged through infiltration from the Mobile River, Cold Creek Swamp and associated wetlands, and rainfall. This aquifer is the principal source of water for users within the Valley. Existing municipal and industrial water supply wells in this aquifer typically yield 470 to 846 gallons per minute (gpm), with specific capacities of 6 to 73 gpm per foot of drawdown. The background water quality is potable, with low total dissolved solids and iron.

- Prior to industrialization the direction of groundwater flow was eastward toward the Mobile River. The water table varied from 0-20 ft below ground level depending on the topography. Presently, the direction of flow is toward the south-southeast due to local influence of pumping at Courtaulds Fibers and from interceptor wells at the southern limits of the LeMoyne Plant. Groundwater usage within the Site area is believed to be limited to the upper aquifer above a clay layer.

- Groundwater is used for industrial processes at several of the surrounding plants. There are two groundwater production wells at the Cold Creek Plant and four groundwater production wells at the LeMoyne Plant. There are two wells used for in-plant drinking water supply at the Cold Creek Plant and no wells used for drinking water at the LeMoyne Plant. These wells are located on the northwest corner of the Cold Creek Plant, up-gradient of the wetland site.

- Groundwater samples were collected from five monitoring wells within and around the wetland at depths varying between 207 and 1,160 feet below ground surface. The ground-water table varied from 0 to 20 feet below ground level depending on the topography. Samples were analyzed for priority pollutants, PCBs, metals, and thiocarbamates. Mercury was detected in several shallow and deep wells at concentrations at or near the detection limit of 0.00020 mg/l. However, mercury was detected above the target concentration of 0.0020 mg/l in one sample.

5.3 NATURAL RESOURCES

- The primary natural resource in the Site vicinity is the Mobile River. In the vicinity of the Site it is approximately 500 ft wide with an average depth of 28 ft. Minimum flow is 4800 ft[3]/sec at a flow velocity of over 0.33 ft/sec. The river flows south, discharging into the Mobile Bay and ultimately the Gulf of Mexico. The river is heavily used for industrial barge transportation with a minor component of recreational use. The Mobile River and the wetland support numerous species of aquatic and terrestrial wildlife.

- In the Mobile River Basin, soil is a key natural resource. In the immediate vicinity of the wetland, timber production (cypress trees and pulp wood) is the only form of agriculture due to the lowland nature of the area and the development of the surrounding uplands for industrial use.

- The Cold Creek drainage system supports diverse wildlife habitats, including forest in the Lower Swamp and scrub-shrub areas, which provide nesting and refuge areas, in the middle of the upland areas.

5.4 BIOTA OBSERVATIONS

- Initial RI study of biological tissue samples, reported in 1988, were collected at four locations within the wetland and at one reference location, and were analyzed for mercury. Levels ranged from below quantification limits to 3.1 mg/kg based on whole-body analysis. A subsequent study by BCM, in 1989, collected finfish, crayfish, and earthworms considered to be representative of the aquatic community in the wetland. These were analyzed for arsenic, chromium, copper, lead, mercury, nickel, and zinc. The study concluded that levels of chromium, copper, mercury, nickel, and zinc in fish exceeded those of reference levels. Upon examination of crayfish samples, levels of chromium, copper, lead, mercury, nickel, and zinc were found to be in excess of their reference levels. Earthworms also were found to contain high levels of arsenic, chromium, copper, mercury, and zinc. Many of the metal concentration levels in the samples were found to be in excess of their reference levels by more than 200%.

- Biota samples of finfish, herptiles, and invertebrates from all three zones of the wetland, as well as reference locations, were analyzed for whole-body mercury tissue concentration during the Supplementary RI, 1990. Based on the analysis, predators (snakes, spotted gar, large-mouth bass, pickerel) contained significantly higher concentrations of mercury than consumers (amphiuma, frogs, toads, bowfin, sunfish, golden shiner, bluegill, carp, eel); however, primary consumers (clams, crayfish) could not be distinguished from upper level consumers. When all tissue samples from all zones of the wetland are combined and compared with reference mercury tissue concentrations, it is apparent that wetland biota tissue mercury concentrations are statistically significantly elevated above reference. Table 5-1 shows the concentrations of mercury found in the tissue of fish, herptiles, and invertebrates found in samples collected in Cold Creek Swamp.

- Threatened and endangered species were determined not to be utilizing the site, via literature search and site reconnaissance.

6.0 SUMMARY OF SITE RISK

CERCLA directs EPA to conduct a baseline risk assessment to determine whether a Superfund Site poses a current or potential threat to human health and the environment in the absence of any remedial action. The baseline risk assessment provides the basis for determining whether or not remedial action is necessary and the justification for performing remedial action.

Based upon the levels of mercury found in the biota of Cold Creek Swamp, it is found that bioaccumulation of mercury is occurring and that mercury is available to the Cold Creek Swamp ecosystem. Mercury concentration values in Cold Creek Swamp far exceed those sediment concentrations of mercury which would be expected to cause ecological effects. Furthermore, the mercury levels in fish exceeded recommended screening levels determined to be protective of avian (0.1 parts per million, ppm) and mammalian (1.1 ppm) species which consume them. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

6.1 CHEMICALS OF CONCERN

The pollutants associated with Cold Creek Swamp are believed to be the result of past disposal practices at the Stauffer Chemical Company processing facility. Mercury contaminated wastewaters from the chlorine processing facility at the LeMoyne Plant were previously discharged into the drainage channel that feeds the Upper Arm Swamp Zone of Cold Creek Swamp.

Assessment of the data indicated that mercury was the primary Chemical of Concern (COC). Other potential COCs that were identified included thiocarbamates, aluminum, cadmium, copper, and zinc. Detailed examination of these compounds based upon risk assessment and mineralogical analyses revealed that mercury was the only critical COC. The mercury will remain in sediments of the wetland until it either converts to methyl mercury and accumulates in biota, releases to overlying surface water, or is physically transported out of the wetland.

6.2 HUMAN HEALTH RISK

Site-specific exposure risks for human health is determined by the possibility of incidental oral ingestion, inhalation, or direct contact. The total excess risk of cancer for potential site exposure should be maintained with the range of 1 x 10[-4] to 1 x 10[-6]. This range is equivalent to an increased chance of one additional case of cancer in 10,000 to 1,000,000. Also, the concentrations of non-carcinogenic chemicals must be lower than those which can lead to chronic health effects. For the Cold Creek Swamp Site, the baseline human health risk assessment indicated that potential human health exposure did not present unacceptable health risks based on the anticipated exposure pathways (see Table 6-1).

The anticipated exposure pathway was based upon the scenario that the conditions at the wetland are not conducive to swimming or wading activities. Therefore, incidental ingestion of water while swimming and contact with sediment while wading were considered non-viable routes of exposure. However, two routes of potential exposure that were examined were oral ingestion of fish and/or shellfish caught recreationally within wetland waters and dermal contact with potentially contaminated water within the wetland during recreational fishing.

The wetland was characterized as being too dry for much of the year to support year-round fishing. Land access to the wetland was limited by posted restrictions for trespassers and the position of the manufacturing facilities. The only access route entailed entrance from the Mobile River, a process considered difficult. Typical fish in the wetland waters were small in size which limited the ingestible amounts of tissue and thus, the potential for contamination. With respect to dermal contact with potentially contaminated water during the course of recreational fishing, exposure was limited to incidental splashing of water on exposed body surfaces. Based upon the isolated nature of the wetland and the limited exposure pathway, the Human Health Risk Assessment did not indicate that the wetland presents an unacceptable risk.

It is important to note that on May 7, 1992, the Mobile County Department of Health issued a "Fish Consumption Advisory" on Cold Creek Swamp. The decision to issue this advisory was based on the findings of the RI, specifically that mercury was detected in fish samples in concentrations greater than the 1 part per million standard set by the Food and Drug Administration for fish consumption. "No fishing" signs were posted along the wetland. Again, the assumption in the Risk Assessment was that land access to the wetland area is limited. Trespassers into the wetland would be at minimal risk if they were exposed, via occasional fishing, to the extent estimated in the risk assessment.

6.3 ECOLOGICAL RISK

The finding of the Baseline Ecological Risk Evaluation is that levels of mercury in Cold Creek Swamp sediments pose a potential risk to receptors. These levels are above the recommended level

protective of piscivorous bird species, 0.1 ppm (Eisler, 1987), which has been adopted as a screening value by Region IV.

Mercury concentrations at the Stauffer Cold Creek site are many times higher than those reported at other mercury contaminated sites. The highest mercury concentrations ranged from 1600 mg/kg (0-1 ft sediment interval) and 7560 mg/kg (1-2 ft sediment interval) in the Upper Arm Swamp Zone to 632 mg/kg (0-1 ft sediment interval) in the Transition Zone at the power lines. As a comparison, background mercury concentrations in sediment found in other areas are between 0.01 to 0.2 ppm.

The mercury concentrations in ecological receptors in the wetland also displayed elevated levels. Carnivorous fish and predatory herptiles showed the highest mercury levels. These levels are above the recommended safe limit of 0.1 ppm for ingestion by sensitive species of birds. Although there are no data indicating mercury levels in birds, concentrations of this magnitude in food items utilized by many bird species which forage in the wetland are likely to result in reproductive impairment. However, 0.1 ppm represents a screening level for mercury contamination in fish tissue that would be considered protective of piscivorous (fish-eating) birds. The findings of the Baseline Ecological Risk Evaluation were that levels of mercury in the wetland sediment poses an unacceptable risk to turtles, snakes, and carnivorous fish since their Hazard Indices was greater than 1. Mercury in the wetland is bioavailable and is accumulating in the tissues of a variety of organisms in the wetland. Based upon these findings, an unacceptable ecological risk is present in Cold Creek Swamp.

The Feasibility Study Report showed that two areas of the wetland are of particular concern. These areas not only have high levels of mercury in sediment but the risk assessment shows a potential risk to biota in the wetland. These areas the Upper Arm (Upper Arm Swamp Zone) and the Middle/Lower Swamp Zone (Transition Zone). The Upper Arm Swamp Zone is the original point of discharge and remains the most highly concentrated source area for contamination driven risks to receptors. The Transition Zone is a sediment depositional area that receives mercury contaminated sediment from the Upper Arm Swamp Zone (Figure 2-1). The Baseline Ecological Risk Evaluation predicted mercury concentrations in organisms throughout the wetland after the sediments in the Upper Arm Swamp Zone and Transition Zone were isolated or removed. The concentrations of mercury in fish, turtles, snakes, alligators, and birds were predicted to fall below levels of concern if contaminated sediment in these two areas were isolated or removed. Therefore, remediation of these two areas is predicted to reduce the exposure of biota to mercury contaminated sediment, and result in reductions in mercury levels in the tissues of resident biota.

In addition, there is evidence that an interconnection exists between Cold Creek Swamp and the Mobile River. Discharge from Cold Creek Swamp occurs as the river stages recede and the water ponding behind the levee seeps out through the levee and flows through the outfall channels from the wetland to the Mobile River. In addition, Cold Creek flows from the upland area west of the Site through Cold Creek Swamp and into the Mobile River. The nature of the riverine system is that sediment and surface water from the river is transported downstream.

6.4 CLEANUP LEVELS

The cleanup levels for Cold Creek Swamp are focused on the uptake of mercury into the biota of Cold Creek Swamp. Because of the nature of mercury in the wetland system and the fact that methylation of mercury is a constant process and very difficult to measure in sediment, the measurement of mercury body burdens is the most accurate method for determining if contaminates in Cold Creek Swamp are at levels which may adversely affect the ecosystem. Therefore, a target level of 0.5 ppm mercury in whole bodies of bottom feeders, carnivorous, and omnivorous fish has been established. These values are based upon the proposed levels set by EPA's Office of Science

and Technology[1].

<Footnote>1 Fish Sampling and Analysis: A Guidance for Issuing Fish Consumption Advisories. Prepared by the Contaminated Fish Section of the Office of Science And Technology, February 1993 Draft.</footnote>

Although this value is based on human health consumption it can be interpolated for consumption of upper trophic level consumers. This value is also consistent with the World Health Organizations[2]

<Footnote>2 Environmental Health Criteria: Methyl mercury. World Health Organization, Geneva, 1990. pp 10-17, 100105.</footnote>

level for safety for human health consumption. In addition, it falls within the range of safety as interpolated from the literature review of Suzuki, 1979[3]

<Footnote>3 Suzuki, T. 1979. Dose-effect and dose-response relationships of mercury and its derivatives. Pages 339-431 in J.O. Nriagu (ed.). The biogeochemistry of mercury in the environment. Elsevier/North Holland Biomedical Press, New York</footnote>

as cited in Eisler, 1987[4] Also, a standard of 1.1 ppm mercury in muscle, kidney, and brain tissue of upper trophic level mammals has been established. This standard is based upon a value of safety as interpolated from the literature review of Eisler (1987).[4]

<Footnote>4 Eisler, R. 1987. Mercury Hazards to Fish, Wildlife, and Invertebrates: A synoptic review. U.S. Fish and Wildlife Service Biological Report 85 (1.10). 90 pp.</footnote>

It is prudent to note that up to this date no standards have been set by EPA for safety of sensitive environments. Although there is no widely accepted level for mercury concentrations in biota tissue, proposed bench mark numbers range from 0.1 to 1.1 ppm. The values established above are based upon scientific studies regarding mercury concentrations and their effects on biota. If standards are established by EPA subsequent to this ROD or new information concerning mercury tissue residues are provided regarding ecological effects or impacts on the food webs, an amendment or explanation of significant differences (ESD) may be necessary to incorporate the established standards.

7.0 DESCRIPTION OF ALTERNATIVES FOR THE UPPER ARM SWAMP ZONE

The following is a description of remedial alternatives evaluated to provide a range of cleanup options for the Upper Arm Swamp Zone. All actions presented below will be conducted in a manner that minimizes impact on wetlands in accordance with federal and state regulations. Table 7-1 is a comparison of feasible alternatives for the Upper Arm Swamp Zone.

7.1 ALTERNATIVE No. 1 - No-Action

The NCP requires that "no action" be evaluated to establish a baseline for comparison. This alternative will involve assessment of the potential for natural recovery through a long-term monitoring program with specified performance milestones, including a five year review. The Upper Arm Swamp Zone sediment contamination will not be further treated, removed, immobilized, nor reduced.

The monitoring program will require the sampling of the biota and frequent measurement of the natural sedimentation process. It will also include evaluation of the impact of storms. Monitoring will continue for five years at which time a projection as to the length of time

required for the total encapsulation could be made (approximately 10 to 30 years).

The 30-year total cost of this alternative is estimated to be $300,000.

7.2 ALTERNATIVE No. 2 - Capping/Surface Water Diversion

Alternative No. 2a: Capping with Surface Water Diversion This alternative will involve a closure of the contaminated area (approximately 25 acres) through capping with clean soil taken from elsewhere onsite. The cap, a 2ft-thick soil layer with a geotextile fabric layer underneath, will be constructed over the area of proposed remediation within the Upper Arm Swamp Zone and will cover the mercury contaminated sediments in the area. The purpose of the cap is to minimize exposure of the wetland biota to mercury-contaminated sediment and to minimize transport to the Lower Swamp by containing the primary mercury source area in the wetland. A new stream channel will be created to divert the surface water flow and by-pass the Upper Arm Swamp Zone.

Sheet piling will be used as in-stream barriers to isolate the Upper and Middle Swamp. The sheet piling will be used in two cross-sections of the Upper Arm Swamp Zone to create "cells" that will be filled and to prevent post-remedial action erosion. Capping soil will then be placed to fill the cells to limit erosion. Finally, reestablishment of native wetland will be needed in the Upper Arm Swamp Zone. In addition, a new channel will be cut to divert the creek around the soil capped Upper Arm Swamp Zone. New wetlands of equivalent functional values will be created to compensate for those lost in the Upper Arm Swamp Zone. The extent of the areal limits will be determined by topography of the Site.

Post-cleanup biota monitoring will be required to assess the longterm effectiveness of capping as a containment action. Annual monitoring will be conducted for the first ten years after remedial action completion.

The Total Cost for the alternative will be approximately $1.45 million.

Alternative No. 2b: Cement Capping with Surface Water Diversion This alternative will be the same as 2a except with the added protection of a cement cap. Restoration will not be possible on the cement cap, but a new drainage channel to divert the creek will be required combined with creation of a new wetland onsite.

The Total Cost for this alternative will be approximately $11.87 million.

Alternative No. 2c: Asphalt Capping with Surface Water Diversion This alternative will be the same as 2b except with an asphalt cap. The protection from infiltration will reduce the potential for any virtual migration of mercury into the groundwater.

The Total Cost for this alternative will be approximately $11.17 million.

Alternative No. 2d: Multi-layer Capping with Surface Water Diversion This alternative will be the same as 2b except with a multi-layer cap appropriate for the disposal of solid waste under the Resource Conservation and Recovery Act (RCRA). This type of cap will consist of a compacted clay layer, a high density polyethylene layer, a drainage layer, a gas vent layer, and a soil revegetation layer. A multi-layer cap will provide additional protection from infiltration and erosion of rainwater. The protection from infiltration will reduce the potential for any virtual migration of mercury into the groundwater, including any downward migration into groundwater. The Total Cost for this alternative will be approximately $11.17 million.

7.3 ALTERNATIVE No. 3 - Excavation/Onsite Treatment/Offsite Disposal

This alternative is a source removal action which will involve the installation of erosion and sediment control and stormwater management provisions. It will also include the excavation of mercury-contaminated sediment in the Upper Arm Swamp Zone, onsite treatment of the soil by stabilization, loading of the treated material onto trucks, and transportation to an approved disposal facility. After contaminated materials have been removed, the Site will be backfilled with clean fill material from an offsite source and, then, revegetated. The Site layout will require specific areas for material handling and preparation, storage, treatment, and loading.

Excavation of contaminated soil will encompass approximately 25 acres (100,000 yd[3]). After excavation, soils analyzed and determined to be at risk will be required to be chemically stabilized onsite prior to transport to an approved land disposal facility. This offsite facility will be approved in accordance with applicable EPA, DOT, and other federal and state regulations.

Post cleanup monitoring will be required to assess the long term performance of this remedial action. Annual monitoring will be conducted for 10 years after implementation of remedial actions.

The total cost for this alternative will be between $21.2 million and $78.2 million.

7.4 ALTERNATIVE No. 4 - Excavation/Onsite Treatment/Onsite Disposal

This alternative is a source area removal and treatment action and will necessitate installing erosion and sediment control and stormwater provisions. The primary components of No. 4 are excavation of mercury contaminated sediments in the Upper Arm Swamp Zone, onsite treatment of the soil by stabilization, onsite disposal in newly constructed onsite landfill, backfilling with clean soil, revegetation, and monitoring. The type of landfill will be determined by the results of a TCLP test. The new landfill construction will require extensive siting, design, and regulatory review.

After the excavation of approximately 25 acres, the soils will be analyzed. The chemicals which were determined to be at risk will require chemical stabilization onsite prior to being placed in the onsite land disposal facility. This facility will be constructed in accordance with applicable federal and state regulations.

Post cleanup monitoring will be required to assess long-term effectiveness of the action. Annual monitoring will be conducted for 10 years after implementation of remedial actions.

The total cost for Alternative 4 will be approximately $30.6 million.

7.5 ALTERNATIVE No. 5 - In-Situ Solidification/Stabilization

Alternative 5 is a source area treatment action. It will entail the installation of erosion and sediment control and stormwater management provisions. It will consist of adding mercury complexing agents directly to contaminated sediment in the Upper Arm Swamp Zone areas of concern to bind the mercury and decrease its availability to the biota. Cement and lime will also be added to solidify the sediments. A total of 25 acres will be treated. This alternative will effectively destroy the 25 acre wetlands of the Upper Arm Swamp Zone, but will allow this zone to continue to function as a channel for stream flow. As a component of this option, mitigation of the destroyed wetlands through the creation of new wetlands at another location on the Site will be necessary.

This alternative will also provide for an extensive study and verification effort to demonstrate ecosystem viability under existing conditions. Annual monitoring will be conducted for ten

years after the execution of remedial actions.

The total cost of this alternative is estimated at $36.5 million.

8.0 DESCRIPTION OF ALTERNATIVES FOR THE TRANSITION ZONE

The alternatives that were developed for the Middle/Lower Swamp Transition Zone are summarized in Table 8-2 on page 28. These alternatives are variations of excavation and capping of the contaminated areas. Alternatives will meet or exceed ARARs and eliminate exposure of receptors to site-related contamination, thus effectively reducing the toxicity. All the alternatives for the Transition Zone can be implemented with any of the alternatives for the Upper Arm Swamp Zone. Table 8-1 is a comparison of feasible alternatives for the Transition Zone.

8.1 ALTERNATIVE No. 1 - No Action Alternative

No action will allow for natural sedimentation of the Middle/Lower Swamp Zone. Sedimentation rates throughout the Middle/Lower Swamp will be observed for 10 years.

The total cost for this alternative will be estimated at $625,000.

8.2 ALTERNATIVE No. 2 - Excavation with Hauling to Upper Arm

This alternative will involve excavating and hauling contaminated sediment, clearing and removing selected wooded areas as applicable, and backfilling and revegetating excavated areas. Of the 25 acre area, approximately five acres between the power line cuts from Cold Creek to the edge of the floodplain will require clearing, in addition to the wooded acres east and west of the power lines. Excavation of 25 acres to a depth of two feet will result in the removal of approximately 80,000 yd[3] of contaminated sediment.

The contaminated sediment will be moved to the Upper Arm Swamp Zone and placed for capping. The excavated area will be backfilled with clean soil and revegetated. To compensate for the loss of wetlands this areas would be restored to wetland status. Mitigation elsewhere on site will be required to compensate for temporal loss of wetland functions and values. The total extent of excavation will be determined during the Remedial Design phase.

Alternative 2 will cost between $1.47 million and $6.57 million.

8.3 ALTERNATIVE No. 3 - Excavation with Onsite Landfill Disposal

Alternative No. 3 will be similar to No. 2, but it will require the excavated material be hauled to an onsite landfill.

The cost for alternative 3 will be between $2.37 million and $28.67 million.

8.4 ALTERNATIVE No. 4 - Excavation with Offsite Landfill Disposal

This alternative is the same as No. 3 with the difference of the excavated material being hauled to an offsite landfill. Alternative 4 will cost between $7.67 million and $69.97 million.

8.5 ALTERNATIVE No. 5 - Capping with soil

Alternative No. 5 will emphasize containment of the contaminated sediment. Sheet piling will be installed in order to isolate the contaminated sediment. If necessary, any wooded areas will be cleared and removed. A geotextile filter fabric will then be placed over the contaminated area

followed by a 2-ft cap of soil which will be revegetated.

The cap will minimize exposure of wetland biota to mercury contaminated sediment by containing the mercury. It will be designed to minimize erosion and control stormwater flow by construction of a 1 percent maximum closure grade. Multiple cells will be constructed to prevent failure.

This Alternative will cost between $1 million and $11.2 million.

8.6 ALTERNATIVE No. 6 - Asphalt Capping

This alternative emphasizes containment of contaminated sediment by covering with a clean soil and with an asphalt cap. Asphalt capping materials which will be placed after regrading and compacting the area and establishing a proper base. Revegetation will not be possible on an asphalt cap. A channel cut will be necessary to maintain surface water flow through the Transition Zone.

This Alternative will cost between $1 million and $11.2 million.

8.7 ALTERNATIVE No. 7 - Multi-layer Capping

Alternative No. 7 will utilize a multi-layer capping approach with highly impermeable clay as part of a system of layers comprising the cap. Revegetation will occur on this type of cap, but it will not be comparable to the destroyed wetland that currently exists. A multi-layer cap will also necessitate cutting a new channel to maintain surface water flow through the Transition Zone.

This Alternative will cost between $1 million and $11.2 million.

The NCP categorizes the nine criteria in Figure 7-1 into three groups:

The selected alternative must meet the threshold criteria and comply with all ARARs or be granted a waiver for compliance with ARARs. Any alternative that does not satisfy both of these requirements is not eligible for selection. The Primary Balancing Criteria are the technical criteria upon which the detailed analysis is primarily based. The final two criteria, known as Modifying Criteria, assess the public's and the state agency's acceptance of the alternative. Based on these final two criteria, EPA may modify aspects of a specific alternative.

9.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES FOR THE UPPER ARM SWAMP ZONE

EPA evaluated each alternative by the standard criteria shown at the top of page 21 to determine which will best reduce risks posed by Cold Creek Swamp. To be considered as a remedy, the alternative must protect human health and the environment and comply with ARARs. Table 9-1 is a summary of comparative analysis of alternatives for the Upper Arm Swamp Zone. Section 121(d) of CERCLA, as amended by SARA, states that any remedial action selected for a site must attain, at a minimum, a degree of cleanup that ensures protection of human health and the environment. In addition, a level or standard of control under any federal or state environmental law that meets legally enforceable ARARs must be attained for any hazardous substance, contaminant, or pollutant remaining on-site at the completion of remedial actions.

Potential ARARs for the Site are listed in section 9.2 COMPLIANCE WITH ARARs.

9.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All of the alternatives will provide adequate protection of human health since the RI indicated that the Site does not represent a human health risk based upon the exposure assumption. All of the alternatives except Alternative No. 1 (No Action/Natural Recovery With Monitoring) will provide protection to the environment. Alternative No. 2 (Capping With Surface Water Diversion) will provide source area containment, but it is questionable whether Alternative 2a (Soil Capping) will protect the groundwater pathway. Alternative No. 3 (Excavation/Onsite Treatment/Offsite Disposal) and Alternative No. 4 (Excavation/Onsite Treatment/Onsite Disposal) provide a short-term reduction in ecological risk. Alternative No. 5 (In Situ Stabilization /Solidification) will also provide source area containment.

Results of the RI indicate that the Upper Arm Swamp Zone is a source area that is contributing to continued uptake of mercury by the biota. Therefore, alternatives that immobilize, treat, or remove the source area contamination will provide a more effective remedial action. Alternative No. 1 is also expected to immobilize the contaminant source area in the long-term through natural sedimentation, but will not do so in the short term. Alternative Nos. 3 and 4 are source area removal actions. Alternative No. 5 is an in situ treatment action.

The primary advantages to removal actions over treatment actions are that the source of contamination is permanently removed and there are permitted disposal facilities within the state of Alabama. Significant disadvantages of removal actions are that there is an initial increase in bioavailable mercury due to the mixing of the system. This increase will asymptotically decrease after the first few years. In addition, offsite disposal will probably require treatment due to mercury concentration in the sediment and may require RCRA permitted disposal (subject to results of Toxicity Characteristic Leaching Procedure, TCLP, testing). Pursuant to SARA, remedial alternatives should prefer permanent treatment of contaminants at the Site.

9.2 COMPLIANCE WITH ARARs

The evaluation of the ability of the alternatives to comply with ARARs includes a review of chemical-specific, action-specific and location specific ARARs, some of which, in the case of Cold Creek Swamp, pertain to wetlands and floodplains. The requirements of federal and state laws are identified and applied to remedial actions as ARARs using the approach outlined in the EPA's CERCLA Compliance with Other Laws Manual (EPA/540/G-89/006, August 1988). Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant or contaminant, location, or other circumstances at a CERCLA site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that are not directly applicable to a hazardous substance, pollutant or contaminant, location, or other circumstances at a CERCLA site, but address problems or situations sufficiently similar to those encountered at the CERCLA site and whose use is well suited to the particular site. The judgment of the relevance and appropriateness of a required action depends on the substances in question or the physical nature of the site.

Section 121 (d) (4) of CERCLA identifies six situations under which compliance with ARARs may be waived:

- The remedial action(s) selected is an interim action and is part of an overall, total remedial action which will attain the ARAR upon implementation

- Compliance with the ARAR will result in a greater risk to human health and the environment than alternative options

- Compliance with the ARAR is technically impracticable from an engineering perspective

- An alternative remedial action will attain an equivalent standard of performance through the use of another method or approach

- The ARAR is a state requirement that the state has not consistently applied (or demonstrated the intent to apply consistently) in similar circumstances

- For Section 104 Superfund-financed remedial actions, compliance with the ARAR will not provide a balance between protecting human health and the environment and the availability of Superfund money for response at other facilities.

In order to comply with CERCLA requirements, selected remedial actions must attain ARARs unless they can claim a waiver under any of the situations described above. Cleanup levels during the RI/FS process will generally be based on chemical-specific and location-specific ARARs or health based levels.

In the event that an ARAR does not exist, other pertinent guidelines and standards should be considered. These are commonly referred to as To-Be-Considered (TBC). Risk-specific doses (RSDs), reference doses (RFDs), health advisories (HAs), and state and federal guidelines and criteria, etc., are examples of TBCs.

All alternatives will meet their respective standards except for Alternatives No. 1 (No Action), No. 2a (Soil Capping), 2b (Cement Capping) and 2d (Asphalt Capping). Alternatives 2a, 2b, and 2c do not meet the RCRA regulations for Solid Waste Management, specifically the closure regulations under 40 C.F.R. Part 258, Subpart F. These regulations are relevant and appropriate requirements for the waste

sludge in the Upper Arm Swamp Zone. Alternative No. 2 will provide for the creation of a new wetland in the area where the new drainage channel will be excavated. This will meet the requirement of the CWA Section 404 and the Alabama Water Quality Standards. Alternative Nos. 3 and 4 assume restoration of wetlands in the Upper Arm Swamp Zone subsequent to source area excavation activities. Excavation alternatives will have to satisfy Clean Water Act requirements during the excavation operations. Alternative No. 5 will require the creation of a wetland at some other location. Any mitigation of wetlands will comply with the requirements of section 404 of the Clean Water Act, the CWA 404(b)(1) guidelines at 40 CFR Part 230, 40 CFR Part 6, Appendix A, and be consistent with the Memorandum of Agreement between the U.S. Army Corps of Engineers and the EPA Concerning the Determination of Mitigation under the 404 (b) (1) Guidelines" (MOA).

The remedial activities may require the discharge of dredged and fill material. Activities which include the discharge of fill material into waters of the United States, including most wetlands, are typically regulated by Clean Water Act Section 404. 33 U.S.C. 1344. In this case CWA Section 404 is applicable and is therefore designated as an applicable or relevant and appropriate requirement (ARAR). Although a CWA 404 permit is not required under CERCLA, EPA is obligated to fulfill the substantive requirements of CWA 404 and the 404(b)(1) guidelines which are included in 40 C.F.R. 230. Although no discharge in a wetland shall be allowed when there is a practicable alternative, the necessity to address contamination in the Cold Creek Swamp leaves no practicable alternative. 40 C.F.R. 230.10(a).

All appropriate and practicable steps must be taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem. 40 C.F.R. 230.10(d). Subpart H of 40 C.F.R. Part 230 sets forth the steps which can be taken to minimize the effects of fill activities. Section 230.75(d) states that habitat development and restoration techniques may be used to minimize

adverse impacts and to compensate for destroyed habitat. These techniques include wetland restoration, enhancement, and/or creation.

If fill activities are unavoidable in order to conduct the remedial actions in Cold Creek Swamp, mitigation shall be required. The "Memorandum of Agreement between the U.S. Army Corps of Engineers and the EPA Concerning the Determination of Mitigation Under the 404(b)(1) Guidelines" (MOA) states that mitigation includes wetland restoration (the favored alternative), enhancement, and/or creation. The evaluation of the appropriate level of mitigation is based solely on the values and functions of the aquatic resource that will be impacted. According to the MOA, mitigation should provide at a minimum one for one functional replacement with an adequate margin of Safety to reflect the expected degree of success associated with the mitigation plan. The MOA considers as a reasonable surrogate a minimum of one to one acreage replacement for no net loss of functions and values. However, the ratio may be greater when the functional values of the area impacted are demonstrably high and the replacement wetlands are of lower functional values or the likelihood of success is low. Conversely, the ratio may be less than one to one when functional values associated with the impacted area are demonstrably low and the likelihood of success of the mitigation project is high. Also, the level of mitigation must also compensate for temporal losses incurred due to the length of time associated with recovery of injured wetlands in restoration and the length of time associated with developing functional values in newly created wetlands.

EPA is also required to mitigate the loss of wetlands under 40 C.F.R. Part 6, Appendix A, implementing Executive Orders-11988 ("Floodplain Management") and 11990 ("Protection of Wetlands"). Executive Order 11988 requires federal agencies to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. Executive Order 11990 mandates that federal agencies minimize the destruction, loss, or degradation of wetlands, and preserve and enhance the natural and beneficial values of wetlands. Appendix A to 40 C.F.R. Part 6 sets forth Agency policy and guidance for carrying out the provisions of the Executive Orders. The Executive Orders apply to activities of federal agencies "providing Federally ... assisted construction and improvements ... and federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities." 40 C.F.R. Part 6, Appx. A, Section 5a.

Another potential ARAR is the Corrective Action Management Unit (CAMU) Rule, 58 Fed. Reg. 8657 (Feb. 16, 1993), which is an ARAR at these Sites. Designation of a CAMU at these Sites achieves the policy objectives of EPA in promulgating the CAMU Rule, most notably, "providing remedial decisionmakers with an added measure of flexibility in order to expedite and improve remedial decisions" which result in effective, protective, and cost-effective remedies and to "override any regulatory disincentive against a given remedy" as the result of Resource Conservation and Recovery Act (RCRA) Subtitle C requirements. 58 Fed. Reg. 8659-60 (Feb. 16, 1993). Pursuant to the CAMU Rule, placement of remediation wastes within a CAMU is not land disposal under Section 3004(k) of RCRA. 42 U.S.C. 6924(k); 40 C.F.R. 264.552(a)(1). Therefore, placement of remediation wastes within a CAMU does not trigger either the Land Disposal Requirements (LDRs) or the Minimum Technology Requirements (MTRs). 40 C.F.R. 264.552 (a) (1) and (2).

"Remediation wastes, are defined as "all solid and hazardous wastes, and all media (including ground water, surface water, soils and sediments) and debris that contain listed hazardous wastes, or which themselves exhibit a hazardous waste characteristic, that are managed at a facility ..." 40 C.F.R. 260.10. The term refers to wastes which originate from remedial activities at the facility or wastes originally located at the facility, but which were associated with a release that migrated beyond the facility boundary. 58 Fed. Reg. 8664 (Feb. 16, 1993). Any sediments that are excavated which exhibit a hazardous waste characteristic or

contains a listed hazardous waste constitute "remediation wastes."

Any placement of excavated contaminated sediments within Cold Creek Swamp does not trigger the LDRs or MTRs because placement of remediation wastes into a CAMU is not land disposal under RCRA Section 3004(k). 42 U.S.C. 6924(k). Pursuant to the Regional Administrator's authority under 40 CFR 264.552 (a), the entirety of Cold Creek Swamp is designated as a CAMU.

The following is a list of potential ARARs:

- 40 CFR Parts 260-270 Hazardous Waste Management Regulations, including regulations pertaining to Corrective Action Management Units effective April 19, 1993.
- 40 CFR Part 257-258 Solid Waste Management Regulations
- Alabama Hazardous Wastes Management and Regulations Act pertaining to treatment, storage, and disposal of mercury-contaminated sediment (subject to results of TCLP testing).
- Clean Water Act and Alabama Water Quality Standards as they pertain to ambient water quality for protection of aquatic life.
- National Pollution Discharge Elimination System pertaining to discharge from any dewatering system to waters of the United States.
- Clean Air Act, National Ambient Air Quality Standards pertaining to control of particulate matter emissions.
- Federal Endangered Species Act, Alabama Non-Game Species Regulation, and Alabama Invertebrate Species Regulation pertaining to impacts on sensitive species.
- Clean Water Act Section 404, and applicable regulations pertaining to wetlands destruction and mitigation, including Clean Water Act 404(b)(1) guidelines at 40 CFR Part 230 and 40 CFR Part 6.302 and Appendix A.
- The Fish and Wildlife Coordination Act of 1989.
- The Fish And Wildlife Conservation Act of 1980.
- Migratory Bird Treaty Act of 1972.
- Rivers and Harbors Act of 1899

The following is a list To Be Considered (TBC):

- Threshold Limit Values, American Conference of Governmental Industrial Hygienists, pertaining to emissions of mercury and mercury compound vapors.
- Federal Executive Order 11988 (Floodplain Management), and Federal Executive Order 11990 (Wetland Protection)
- State of Alabama proposed Regulations on Municipal Solid Waste Landfills
- EPA Guidance on Final Covers on Hazardous Waste Landfills and Surface Impoundments, July 1989

. Memorandum of Agreement between the U.S. Army Corps of Engineers and the EPA Concerning the Determination of Mitigation Under the 404 (b)(1) Guidelines.

. Long, Edwards R. and Lee, G. Morgan. 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA No. 52.

9.3 LONG-TERM EFFECTIVENESS

The capping alternative (No. 2), the excavation/disposal alternatives (Nos. 3 and 4), and the in situ treatment alternative (No. 5) will provide long-term effectiveness, because these alternatives will use processes to reduce hazards posed by all known contaminants at the Site.

Alternative No. 2 (Capping) provides an impermeable barrier to prevent contact of the contaminated sediments by biota. This barrier should effectively minimize bioaccumulation of mercury from the source area. Capping is an effective long-term action provided that regular inspection and maintenance is conducted. Alternative 2a (Soil Capping) may not provide a reduction in the mobility of contaminants through the groundwater pathway.

Alternative Nos. 3 and 4 are excavation/disposal alternatives. These options require that contaminated material be excavated and removed from the designated source area. Alternative No. 3 provides for permanent removal of the contamination from the Site. Alternative No. 4 does not.

Alternative No. 5 uses in situ solidification/stabilization to treat the contaminated sediments in the source area. This technology, although effective in remediation of Sites with contaminated soil, is not proven for long-term effectiveness for mercury-contaminated soil. Treatability testing will be required.

9.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

Alternative No. 1 (No Action) and 2 (Capping) do not involve treatment and therefore, cannot be addressed here as reducing the toxicity, mobility, or volume.

Alternative Nos. 3 and 4 will provide for good long-term reduction of toxicity and mobility, in addition to providing a reduction of volume, because these alternatives will provide for removal, treatment, and offsite disposal of contaminated soils. These alternatives, however, will allow for short-term increase in contaminant mobility and toxicity for the first year after implementation of the action due to resuspension/increased bioavailability of mercury. Alternative No. 5 will provide for good reduction of toxicity and mobility of contaminants through treatment, but will not provide volume reduction since materials will be added for solidification/stabilization.

9.5 SHORT-TERM EFFECTIVENESS

All alternatives except for No. 2 will not provide short-term effectiveness. Alternative No. 2 (Capping) is anticipated to have the greatest short-term effectiveness.

The excavation/disposal alternatives (Nos. 3 and 4) will present the greatest risk from sediment suspension and transport. Excavation will release increased amounts of mercury into the system for the short term; in addition, there are hazards associated with offsite transport of contaminated sediment. Another short-term risk associated with Alternative No. 4 will be storage of excavated wastes prior to treatment.
The in-situ treatment action (Alternative No. 5) will result in the least short-term

environmental impact as sediments are made bioavailable during the in-situ mixing process. Alternative No. 5 requires significant Site disturbance to implement.

Alternative Nos. 2 and 5 could be implemented within 6-9 months. Alternative No. 3 could be completed within 9-12 months. Alternative No. 4 will require at least 1-3 years.

9.6 IMPLEMENTABILITY

Alternative No. 1 (No Action/Natural Recovery) will be the simplest to implement. This alternative will include long-term monitoring of sediment, biota, and surface water to assess performance of natural recovery.

Alternative No. 2 (capping) will be relatively simple to construct and operate. Alternative No. 2 will include construction of a cap to eliminate the mercury sediment-water interface where methylation occurs and to contain source area contamination in-place. This is a common construction practice. Long-term monitoring and maintenance will be an essential component of this alternative.

Alternative No. 3 (Excavation/Offsite Disposal) will present significant difficulties during excavation and handling of contaminated sediment. Excavation/dredging will present construction-related and health related concerns. Transport and offsite disposal will require permitting and coordination with the State of Alabama and the EPA-approved facility and might require consideration of RCRA transport and disposal requirements. Availability and capacity for offsite disposal is adequate, since the Emelle, Alabama, facility is located less that 200 miles from the Site.

Alternative No. 4 (Onsite Disposal) will present the most difficulties in implementation. Excavation and material handling concerns will also apply to this alternative. Onsite treatment will require construction of a facility for treating the contaminated sediments. Onsite disposal will require construction of a landfill on plant property. Storage provisions for excavated wastes will be required.

In situ Solidification/Stabilization (Alternative No. 5) will be even more complex than the capping and excavation with offsite disposal alternatives previously discussed, particularly due to the wetland environment. Vast amount of material would have to be introduced into the wetland in order to solidify/stabilize the sediment. Treatability testing and specialized equipment for mixing wetland sediments will be required.

9.7 COST

Alternative No. 2 (Capping) is the most cost-efficient of the alternatives, excluding alternative No. 1 (No action). Examination of costs indicates that the capital costs for Alternative No. 3 (Excavation/Disposal) are approximately 6 to 71 times more than the capital costs for Alternative No. 2. Capital costs for Alternative Nos. 4 and 5 (assuming mercury-contaminated sediment to be classified as non-hazardous under RCRA) are approximately 3 to 40 times more than those for Alternative No. 2. Operation and maintenance costs for all alternatives are fairly comparable. A summary of costs for each of the remedial alternatives is provided in Table 9-1.

10.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES FOR THE TRANSITION ZONE

EPA evaluated each alternative by the standard criteria shown at the top of page 21, and further explained in section 9.0 relating to the Upper Arm Swamp Zone, to determine which will best reduce risks posed by Cold Creek Swamp. To be considered as a remedy, the alternative must

protect human health and the environment and comply with ARARs. Table 10-1 is a summary of comparative analysis of alternatives for the Transition Zone.

10.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Based on the assumption in the Remedial Investigation that the Site does not represent a human health risk, all of the alternatives will provide adequate protection of human health. However, the Feasibility Study Report indicated that the Middle/Lower Swamp Transition Zone is a source area that may be contributing to continued uptake of mercury by the biota. Therefore, all alternatives except for Alternative No. 1 will provide for protection of the environment.

Alternative Nos. 2, 5, 6, and 7 will be actions taken totally within the confines of Cold Creek Swamp. Alternative Nos. 3 and 4 will be designed to remove sources of contamination from Cold Creek Swamp. Alternative No. 1 is also expected to immobilize the contaminant source area in the long-term through natural sedimentation, but will not do so in the short term.

Alternative No. 2 (Excavation/Haul to Upper Arm for Capping), Alternative No. 3 (Excavation/Treatment/Onsite Disposal) and Alternatives 5, 6, and 7 are all capping alternatives. They will change the topography of the Middle/Lower Swamp Transition Zone which will result in a change in hydrology. Each of these alternatives will have and a definite ecological impact, but to an uncertain degree.

Alternatives 3 and 4 will permanently remove the contamination from Cold Creek Swamp. Alternative No. 4 (Excavation/Treatment/Offsite Disposal) will result in an immediate short-term ecological risk.

10.2 COMPLIANCE WITH ARARs

All alternatives will meet their respective ARARs except for Alternative No. 1 (No action). Wetland and sediment erosion control requirements must be considered for Alternatives 2 through 7. Excavation alternatives (2, 3, 4) will have to satisfy Clean Water Act requirements during the excavation operations. Mitigation (restoration) of wetlands will comply with the requirements of Section 404 of the Clean Water Act, the CWA 404(b)(1) guidelines at 40 CFR Part 230, and 40 CFR Part 6, Appendix A, and be consistent with the "Memorandum of Agreement between the U.S. Army Corps of Engineers and EPA Concerning the Determination of Mitigation Under the 404 (b) (1) Guidelines. Any movement of contaminated sediment within the wetland will comply by the RCRA regulations relating to Corrective Action Management Units (CAMUs) under Subtitle C.

A list of applicable ARARs may be found in section 9.2 Compliance with ARARs for the Upper Arm Swamp Zone.

10.3 LONG-TERM EFFECTIVENESS

All alternatives except for No. 1 will provide long-term effectiveness. Alternative Nos. 2, 3, and 4 are excavation/disposal alternatives. These options will require that contaminated material be excavated and removed from the designated source area. They will remove mercury contaminated sediments and backfill 2 feet of soil to render any residual contamination nonbioavailable.

Alternative No. 2 will involve disposal in the Upper Arm Swamp Zone and is conditional upon the selection of capping or the remedial alternative for the Upper Arm Swamp Zone being a selected remedy. In Alternative No. 3, waste will be treated and disposed of in a newly constructed landfill on the Cold Creek/LeMoyne Plant Site. Alternative No. 3 will provide for source area removal, but not for removal of contaminants from the Plant Site. In Alternative No. 4,

waste is treated and taken to an EPA-approved offsite disposal facility. This approach moves contaminated sediment to another location. Alternative No. 4 will provide for permanent removal of the source of mercury contamination from the Site provided capacity is available.

Alternative Nos. 5, 6, and 7 will cover contaminated sediment and provide a barrier to prevent contact of the contaminated sediments by biota. This barrier should effectively preclude bioaccumulation of mercury as a result of contact with the source area. Capping will be an effective long-term action provided that regular inspection and maintenance are conducted.

10.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME BY CONTAINMENT

Alternative No. 1, 2, 5, 6, and 7 do not involve treatment, and therefore, cannot be addressed here as reducing toxicity, mobility, or volume.

Alternative Nos. 3 and 4 will provide for long-term reduction of toxicity and mobility. These alternatives, however, will allow for short-term increase in contaminant mobility and toxicity after implementation of the action due to resuspension/increased bioavailability of mercury.

10.5 SHORT-TERM EFFECTIVENESS

Alternative No. 1 (No Action) will have little or no effect on the surrounding environment in the short-term.

The excavation alternatives (Nos. 2, 3, and 4) will present significant environmental risk from sediment suspension and transport. There are also hazards associated with offsite transport of contaminated sediment. Another short-term risk associated with Alternative Nos. 3 and 4 will be storage of excavated wastes prior to treatment.

Alternative Nos. 5, 6, and 7 will be anticipated to have the greatest short-term effectiveness. These alternatives will present the least amount of risk to workers, the community, and the environment.

Alternative No. 5 could be implemented within 6-9 months. Alternative No. 2 could be completed in 9-12 months and will be implemented simultaneously with capping of the Upper Arm Swamp Zone if this remedy were selected. Alternative No. 4 could also be implemented in 9-12 months. Alternative No. 3 could take several years to implement because of the technical issues associated with the siting and specification process. Alternatives 6 and 7 will also take several years to implement because of the need to allow for sediment dewatering. This could be a problem due to the high rainfall in the local area.

10.6 IMPLEMENTABILITY

Alternative No. 1 will be the simplest to implement. This alternative will include a 5 year monitoring of sediment and mercury body burdens in fish. It will also include an analysis of the Cold Creek Swamp system viability by way of comparison to a similar non-contaminated wetland system(s).

Alternative No. 2 will be relatively simple to implement. However, it is linked with the capping of the Upper Arm Swamp Zone if this approach is selected. Excavation/dredging will present construction-related and health related concerns. If contaminated sediment is hauled from the Transition Zone to the Upper Arm Swamp Zone, it will not trigger the RCRA Land Disposal or Minimum Technology Regulation because it will be movement of remediation wastes within a Corrective Action Management Unit (CAMU). The CAMU is the entirety of Cold Creek Swamp (Figure 2-1).

Alternative No. 3 will present difficulties in implementation. Transport and offsite disposal will require coordination with the State of Alabama and the EPA-approved facility and might require consideration of RCRA transport and disposal requirements, and subject to results of TCLP testing. Onsite treatment, if necessary, will require construction of a facility for treating the contaminated sediments. Onsite disposal will require construction of a landfill on Cold Creek/LeMoyne plant property. Provisions for storage of excavated wastes will be required.

Alternative No. 4 will present some concern with transporting contaminated sediment across the Plant Site and to the disposal facility. Excavation and dredging concerns will be the same as Alternative No. 2 above.

Alternative No. 5 will also be relatively simple to construct and operate. Alternative No. 5 will include construction of a cap to eliminate the mercury sediment-water interface where methylation occurs and to contain source area contamination in-place. This activity is not a difficult construction practice and will not require specialized expertise. Long-term monitoring and maintenance will be essential.
Alternatives 6 and 7 will present significant construction difficulties due to the need to establish a base for cap construction. Dewatering effectiveness might be a problem. This could ultimately lead to a cap which quickly fails due to cracking. These alternatives will also require evaluation of impact to the powerline support structures.

10.7 COST

Alternative No. 1 will be the least expensive. For cleaning up the 7 acres under the powerline cuts, the costs of Alternative Nos. 2 and 5 will be comparable. Costs associated with remediating 25 acres are all comparable.

Alternative Nos. 6 and 7 will be far more complicated capping approaches than just using a natural soil cap (Alternative No. 5) and will be three times more expensive than Alternative 5. The most expensive will be Alternative Nos. 3 and 4 if treatment were required prior to disposal.

11.0 STATE ACCEPTANCE

EPA has consulted with the Alabama Department of Environmental Management and received a letter dated September 1, 1993 indicating State concurrence on the Record of Decision (ROD), which will document EPA's remedy selection. See Appendix B.

12.0 COMMUNITY ACCEPTANCE

EPA will determine community acceptance of the preferred alternative after considering comments received during the public comment process associated with the Proposed Plan. EPA will include a Responsiveness Summary as an attachment to the ROD in Appendix A explaining how it addressed those comments.

13.0 SUMMARY OF SELECTED REMEDY

The objectives of the selected remedy are to reduce concentration of hazardous substances, pollutants, and contaminants in sediment in Cold Creek Swamp; prevent or mitigate the continued release of hazardous substances, pollutants, and contaminants to all exposure pathways, including groundwater, surface water bodies, and sediments of Cold Creek Swamp and the Mobile River; eliminate or reduce the risk to ecological receptors due to exposure to hazardous substances, pollutants, and contaminants in Cold Creek Swamp.

EPA's selected cleanup alternative for the contamination and associated risks in Cold Creek Swamp is based upon a number of factors including mercury levels in sediment, mercury levels in biota, recommended levels of safety as found in the literature, the information contained in the ecological risk assessment, and the risk to the ecosystem presented by the selected remedy. For the Upper Arm Swamp Zone (Figure 2-1) of Cold Creek at the Stauffer Chemical Superfund Sites, the selected remedy is No. 2d, Multi-layer Capping and Containment of the Upper Arm with a Surface Water Diversion including Long-Term Monitoring of the entire wetland. This alternative will include burial of the mercury contaminated soils in place. The multi-layer cap will add additional protection from infiltration and prevention of migration to groundwater. The selected alternative will include creation of a new channel to divert surface water flow and by-pass the capped Upper Arm Swamp Zone along with creation of a new wetland in the new channel. The determination of the appropriate level of mitigation will be based upon functional equivalency of wetland values lost taking into consideration the likelihood of success in creating new wetlands and consistency with the MOA. The remedy also includes long-term monitoring of the wetland to determine if making contaminants immobile will provide necessary protection of people and the environment. The criteria for this determination will be 0.5 ppm of mercury in whole body fish (bottom feeders, carnivores, omnivores) and 1.1 ppm of mercury in muscle, kidney, and brain tissue of upper trophic levels of mammals. Also an evaluation of the toxicity to biota in Cold Creek Swamp will be required. This will provide the best balance of the evaluation criteria. The total estimated cost is $11,170,000. EPA believes this remedy will be fully protective, will meet standards, and will use permanent solutions.

EPA's selected alternative for the Middle/Lower Swamp Transition Zone of Cold Creek is Alternative 2d which is the excavation of the Transition Zone and hauling it to the Upper Arm Swamp Zone for capping; the total extent of excavation will be determined during the Remedial Design. This will also include restoration of the Transition Zone and continued monitoring of the entire wetland. Mitigation onsite will be required to compensate for temporal loss of wetlands. The determination of the appropriate level of mitigation will be based upon functional equivalency of wetland values lost taking into consideration the likelihood of success in creating new wetlands and consistency with the MOA. The total estimated cost will be $ 6,570,000. The total cost of remediation of the Upper Arm Swamp Zone and the Transition Zone is $17,740.000.

The monitoring for the remedy implementation shall include, but not be limited to, pre-activity sampling, sampling during remedial implementation, and post remedial sampling including ultra-detection limits for mercury in water and methyl mercury determination in sediments. It should also include, but not be limited to sediment chemistry, toxicity testing, and bioaccumulation measurements. If any of this monitoring shows unacceptable levels as set out in this ROD, additional remediation may be required. Monitoring will also include periodic analysis of the success of any mitigation efforts. If mitigation efforts are unsuccessful as set forth in this ROD, additional mitigation shall be required.

In addition, EPA will require institutional controls which include a building up of the levees between Cold Creek Swamp and the Mobile River so as to limit exchange of contaminants from Cold Creek Swamp to the Mobile River. These levees will also be vegetated. This is the addition of clean fill sediment to the current levees. These levees will be designed to minimize any alteration of hydrology, to maintain historic seasonal water levels, and to maintain present hydroperiod in Cold Creek Swamp. Mitigation will be required to compensate for any direct or indirect wetland losses due to the impacts of the levees. Again, the determination of the level of mitigation will be based upon functional equivalency considering the likelihood of success and consistent with the MOA. Posting of "No Fishing" and "No Hunting" signs and strict security to prevent trespassing into Cold Creek Swamp will also be included.

EPA feels this proposed remedy will reduce high levels of mercury concentration in sediment and

reduce risk of mercury contamination in all exposure pathways for ecological receptors in Cold Creek Swamp.

Mitigation requirements set out in this ROD do not comprise mitigation requirements as compensation for damages to natural resource trusts.

14.0 STATUTORY DETERMINATION

Under its legal authority, EPA's primary responsibility at Superfund Sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedy also must be cost effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous substances as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

14.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy protects human health and the environment, particularly the ecological environment of Cold Creek Swamp, through isolating and removing the principal contaminated sediments of the wetland and long-term monitoring. The protection of human health and the environment is provided by consolidation and containment of contaminated sediment in the Upper Arm Swamp Zone and removal of contaminated sediment in the Transition Zone and containment of any residual contamination within Cold Creek Swamp. In so doing the risk is reduced for uptake of contaminants into biota which in turn reduces any risk to humans ingesting contaminated biota. It also reduces risk to groundwater by containment with a multi-layer cap. In addition, the risk is also controlled through institutional controls and long-term monitoring.

14.2 ATTAINMENT OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Remedial actions performed under CERCLA must comply with all applicable or relevant and appropriate requirements (ARARs). All alternatives considered for Cold Creek Swamp were evaluated on the basis of the degree to which they complied with these requirements. The selected remedy was found to meet or exceed all ARARs listed below:

14.3 COST EFFECTIVENESS

EPA believes that the selected remedy will reduce the risk to human health and the environment from the contaminated sediment at a cost of $17,740,000. The selected remedy 2d for the Upper Arm Swamp Zone, though slightly more expensive than the similar 2a, provides a higher level of long term protectiveness by capping the contaminated sediment with a compacted clay layer, a high density polyethylene layer, a drainage layer, a gas venting layer, and a soil revegetation layer. This cap provides additional protection from infiltration and erosion of rainwater and migration to groundwater. The remedy is much less expensive than the other alternatives for the Upper Arm Swamp Zone.

The selected remedy for the Transition Zone of 2d, though slightly more expensive than the capping alternatives, allows for permanent removal of the contaminated sediment and restoration back to a wetland status. This will decrease migration of contaminants to the Mobile River during flooding and increase the functional value of the Transition Zone. The cost of excavation in this area will vary depending on the amount of material that will ultimately be removed, since only a portion of the 25 acre area will be removed, the total cost is expected to

be less than proposed. The cost of this alternative is within the medium range for cost alternatives in the Transition Zone.

14.4 UTILIZATION OF PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

EPA believes the selected remedy is the most appropriate cleanup solution for Cold Creek Swamp and provides the best balance among the evaluation criteria for the remedial alternatives evaluated. This remedy provides effective protection over the long-term life of the wetland for potential human and environmental receptors, is implementable, and is cost effective.

14.5 PREFERENCE FOR TREATMENT AS A PRINCIPLE ELEMENT

The statutory preference for treatment will not be met because treatment of the contaminated sediment will assist in not accomplishing the goals of reducing bioavailable mercury in Cold Creek Swamp. The mercury in the sediments is in the fairly stable form of mercury sulfide and is not expected to fail the toxicity characteristic leaching test. Any further treatment before burial will not significantly alter the stability of the mercury in the sediment. The act of capping the sediment will in itself limit the bioavailability of mercury. Because treatment of the principal threats of the site was not found to be practicable, it was not required in this decision.

15.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan was released for public comment in July 1993. It identified alternative 2d for the Transition Zone which included excavation of 25 acres to a depth of 2 feet. During the public comment period, commentors expressed concerns regarding excavation of all 25 acres of the Transition Zone since some areas did not show extensive sediment contamination. To address these concerns, the remedy was refined to include sampling during Remedial Design to better define the areas containing sediment contamination. Only specific areas containing contaminated sediment will be excavated so as to reduce the disturbance to the environment.

Also the requirement to analyze liver tissue of upper trophic level mammals was removed since investigation pursuant to a comment on the proposed plan determined that liver tissue was not appropriate. The 1.1 ppm mercury standard in kidney, brain, and muscle remains.

OU3 Alternatives No. 2d

APPENDIX A:

RESPONSIVENESS SUMMARY

ALABAMA
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

September 1, 1993

Ms. Joanne Benante
Remedial Project Manager
South Superfund Branch
U.S. Environmental Protection Agency
345 Courtland Street, NE
Atlanta, Georgia 30365

RE: Stauffer Cold Creek Swamp
Draft Record of Decision
Reference No. 306

Dear Ms. Benante:

ADEM has reviewed the referenced Draft Record of Decision. Based on our review, we concur with the Draft Record of Decision without further comments.

If there are questions regarding this matter, please contact Mr. C.H. Cox of Special Projects at (205) 260-2785.

Sincerely,

Leigh Pegues
Director

LP/CHC/sps

OU3 Alternative No. 2d

APPENDIX C:

STATEMENT OF FINDINGS

STATEMENT OF FINDINGS
STAUFFER CHEMICAL COMPANY-LEMOYNE PLANT
STAUFFER CHEMICAL-COLD CREEK PLANT
COLD CREEK SWAMP (OU3)
MOBILE COUNTY, ALABAMA

This document has been prepared to fulfill the substantive requirements of the Floodplain Management Executive Order (E.O. 11988), and the Protection of Wetlands Executive Order (E.O. 11990), and Appendix A of 40 C.F.R. Part 6, entitled Statement of Procedures on Floodplain Management and Wetland Protection.

(i) The reason why the proposed action must be located in or affect the floodplain or wetland is as follows.

This Record of Decision addresses Cold Creek Swamp (OU3). The wetland received contaminated wastewaters from the former operations at the manufacturing facilities. A June 1992 Supplemental Remedial Investigation Report documents the details of the study of contamination in the wetland. A November 1992 Supplemental Feasibility Study Report and the March 1993 Supplemental Feasibility Study Report Addendum submitted by Akzo Chemicals Inc./Zeneca Inc., documents the development, screening, and detailed evaluation of potential alternatives and risk posed by the contaminants as they relate to the Site. Furthermore, EPA has issued a December 10, 1992, caveat to the RI Report and a June 3, 1993, caveat to the FS Report.

Based upon the levels of mercury found in the biota of Cold Creek Swamp, it is found that bioaccumulation of mercury is occurring and that mercury is available to the Cold Creek Swamp ecosystem. Mercury concentration values in Cold Creek Swamp far exceed those sediment concentrations of mercury which would be expected to cause ecological effects. Furthermore, the mercury levels in fish exceeded recommended screening levels to be protective of avian (0.1 parts per million, ppm) and mammalian (1.1 ppm) species which consume them. Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or, the environment.

(ii) A description of significant facts considered in making the decision to locate in or affect the floodplain or wetland including alternative sites and actions is as follows.

The Feasibility Study Report showed that two areas of the wetland are of particular concern. These areas not only have high levels of mercury in sediment but the risk assessment shows a potential risk to biota in the wetland. These areas are the Upper Arm (Upper Arm Swamp Zone) and the Middle/Lower Swamp Zone (Transition Zone). The Upper Arm Swamp Zone is the original point of discharge and remains the most highly concentrated source area for contamination driven risks to receptors. The Transition Zone is a sediment depositional area that receives mercury contaminated sediment from the Upper Arm Swamp Zone (Figure 2-1). The mercury will remain in sediments of the wetland until it either converts to methyl mercury and accumulates in biota, releases to overlying surface water, or is physically transported out of the wetland.

The Baseline Ecological Risk Evaluation predicted mercury concentrations in organisms throughout the wetland after the sediments in the Upper Arm Swamp Zone and Transition Zone were isolated or removed. The concentrations of mercury in fish, turtles, snakes, alligators, and birds were predicted to fall below levels of concern if contaminated sediment in these two areas were

isolated or removed. Therefore, remediation of these two areas is predicted to reduce the exposure of biota to mercury contaminated sediment, and result in reductions in mercury levels in the tissues of resident biota.

In addition there is evidence that an interconnection exists between Cold Creek Swamp and the Mobile River. Discharge from Cold Creek Swamp occurs as the river stages recede and the water ponding behind the levee seeps out through the levee and flows through the outfall channels from the wetland to the Mobile River. In addition Cold Creek flows from the upland area west of the site through Cold Creek Swamp and into the Mobile River. The nature of the riverine system is that sediment and surface water from the river is transported downstream.

(iii) A statement indicating whether the proposed action conforms to applicable State or local floodplain/wetland protection standards is as follows.

Remedial actions performed under CERCLA must comply with all applicable or relevant and appropriate requirements (ARARs). All alternatives considered for Cold Creek Swamp were evaluated on the basis of the degree to which they complied with these requirements. The selected remedy was found to meet or exceed all floodplain/wetland protection ARARs and TBCs listed below:

- Clean Water Act: Section 404 including the CWA 404(b)(1)guideline at 40 CFR 230, 40 CFR 6 and Appendix A, National Pollution Discharge Elimination System.
- Federal Endangered Species Act (50 CFR Part 402).
- Fish and Wildlife Coordination Act of 1989.
- Fish and Wildlife Conservation Act of 1980.
- Migratory Bird Treaty Act of 1972.
- River and Harbors Act.
- State of Alabama: Alabama Water Quality Standards, Alabama Non-Game Species Regulations, Alabama Invertebrate Species Regulations.
- Threshold Limit Values, American Conference of Governmental Industrial Hygienists.
- Federal Executive Order 11988 (Floodplain Management), and Federal Executive Order 11990 (Wetland Protection).

(iv) A statement indicating how the proposed action affects the natural or beneficial values of the floodplain or wetland is as follows.

The selected remedy protects human health and the environment, particularly the ecological environment of Cold Creek Swamp, through isolating and removing the principal contaminated sediments of the wetland and long-term monitoring. The protection of human health and the environment is provided by consolidation and containment of contaminated sediment in the Upper Arm Swamp Zone and removal of contaminated sediment in the Transition Zone and containment of any residual contamination within Cold Creek Swamp. In so doing the risk is reduced for uptake of contaminants into biota which in turn reduces any risk to humans ingesting contaminated biota. It also reduces risk to groundwater by containment with a multi-layer cap. In addition, the risk is also controlled through institutional controls and long-term monitoring.

Only the most heavily contaminated portions of the wetland will be compromised. To replace the compromised areas, EPA's remedy requires mitigation. The new diversion channel will be revegetated in order to create a new wetland for the capped area Upper Arm Swamp Zone. The remedy also requires reestablishment of wetlands in the excavated areas of the Transition Zone. These reestablished, uncontaminated wetlands will have a higher functional value than the current contaminated wetlands. The remedy requires no net loss of wetlands.